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(54) **ELECTRICAL CONNECTOR WITH GROUNDING MECHANISM CONTACTING OUTER SHELL**

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H01R 24/70 (2011.01)
H01R 13/6587 (2011.01)
H01R 13/6594 (2011.01)

(52) **U.S. Cl.**

CPC ***H01R 24/70*** (2013.01); ***H01R 13/6587*** (2013.01); ***H01R 13/6594*** (2013.01)

(58) **Field of Classification Search**

CPC H01R 13/6581; H01R 13/6587; H01R 13/6591; H01R 13/6594
USPC 439/79, 607.27, 607.35, 660
See application file for complete search history.

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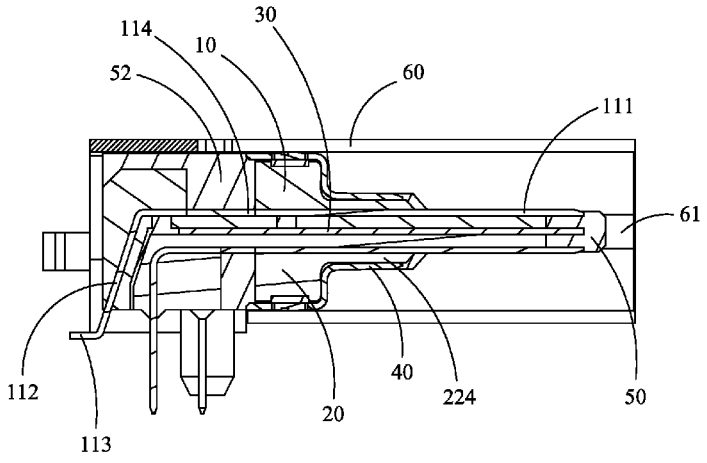
(57) **ABSTRACT**

An electrical connector includes an upper contact module, a lower contact module, an outer insulative housing inject-molded with the upper contact module and the lower contact module, a shielding mechanism at least partly fixed in the outer insulative housing and a metallic outer shell enclosing the outer insulative housing. The upper contact module includes a number of upper contacts and an upper housing inject-molded with the upper contacts. The lower contact module includes a number of lower contacts and a lower housing inject-molded with the lower contacts. The shielding mechanism and the metallic outer shell are in mechanical contact with each other for achieving a relative larger grounding area.

19 Claims, 12 Drawing Sheets



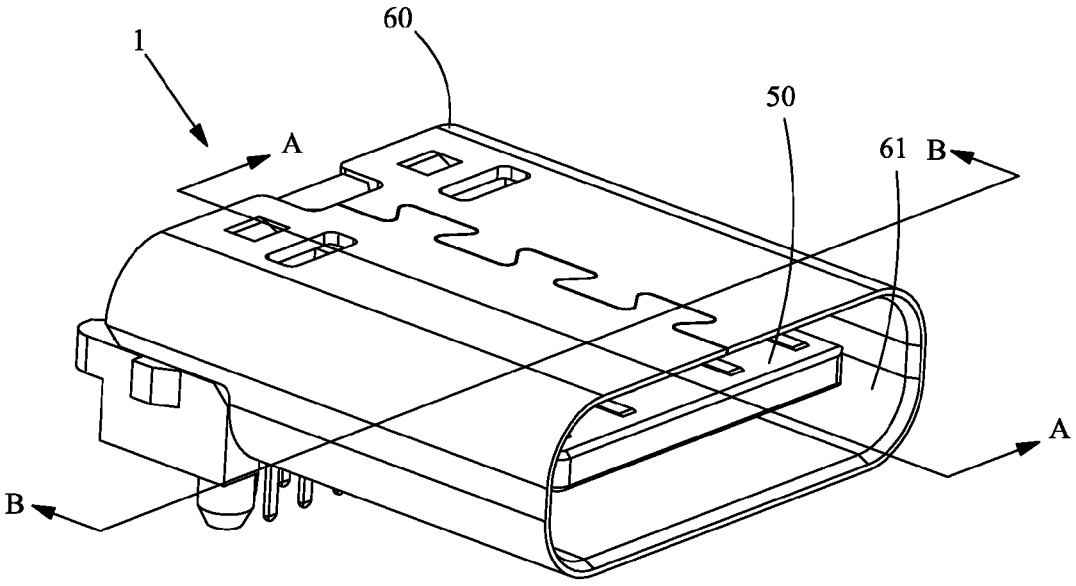


FIG. 1

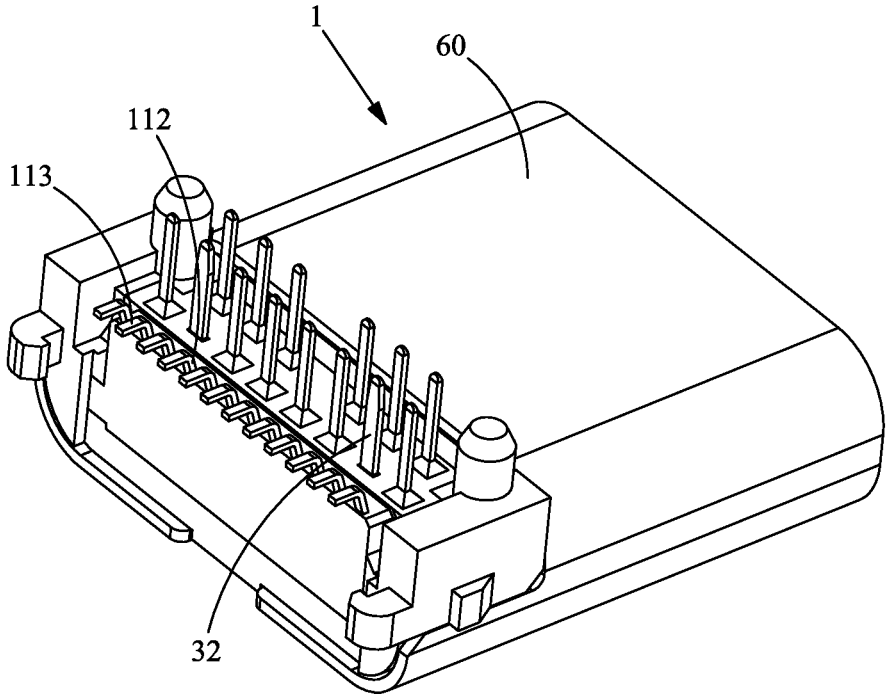


FIG. 2

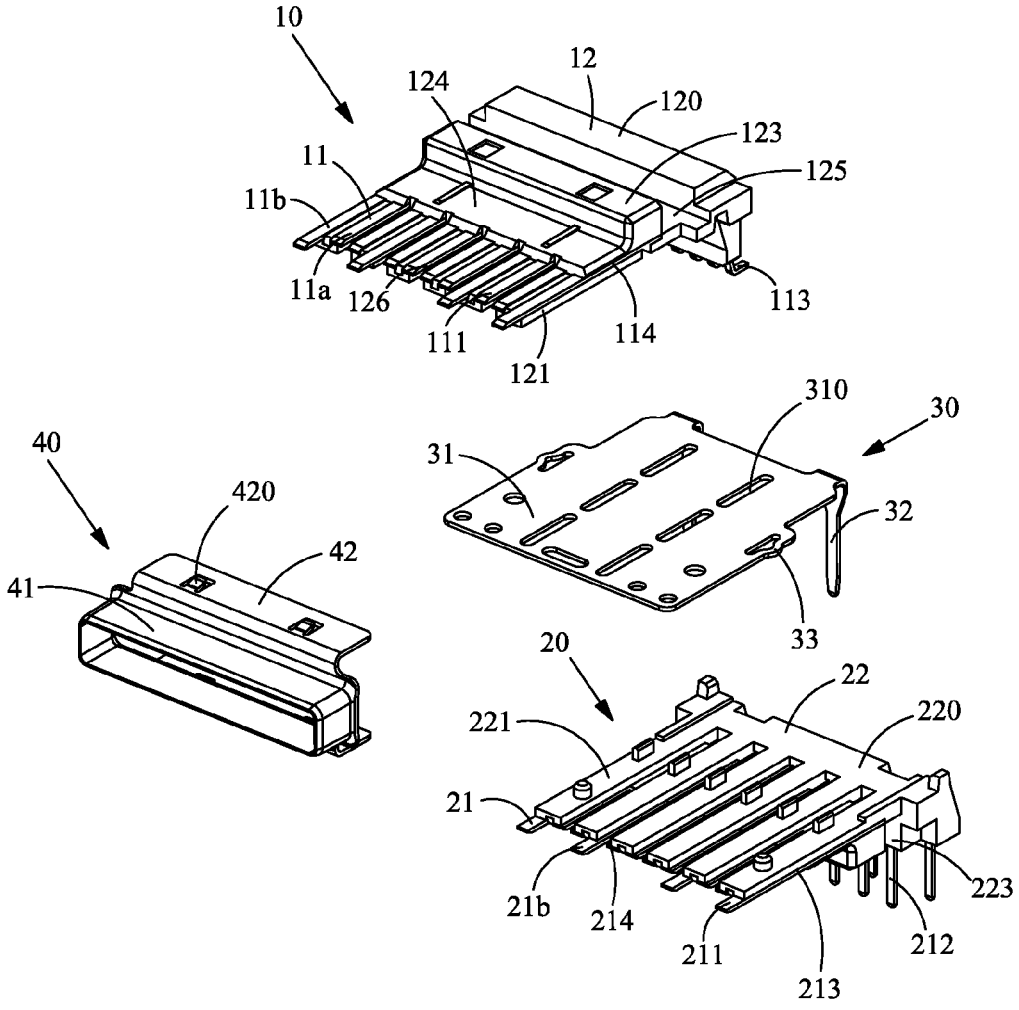

10
12
124
120
123
11
125
11b
11a
126
111
121
114
113
40
420
42
41
310
30
31
32
33
20
22
221
220
21
21b
214
211
213
212
223

FIG. 3

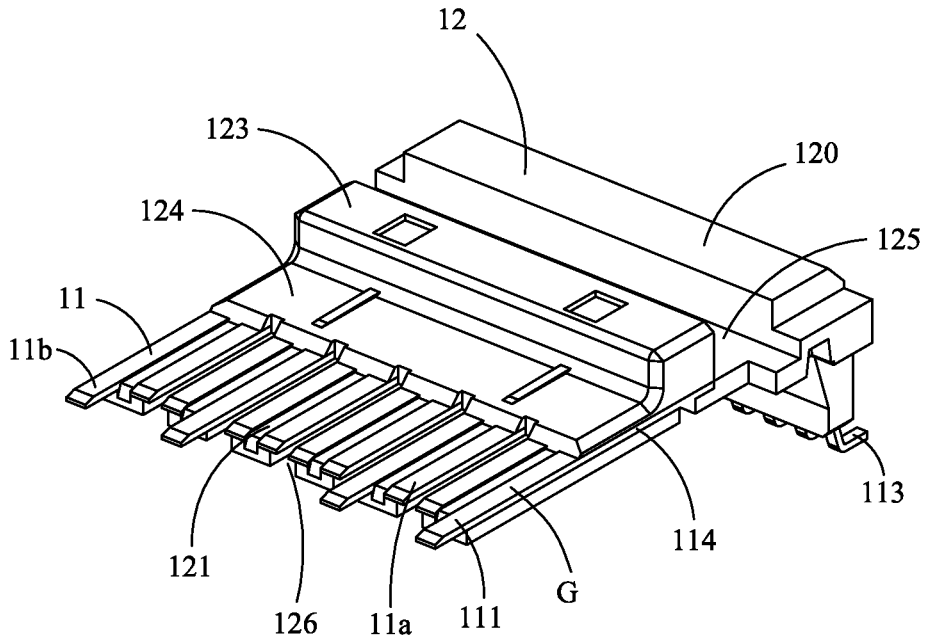


FIG. 4

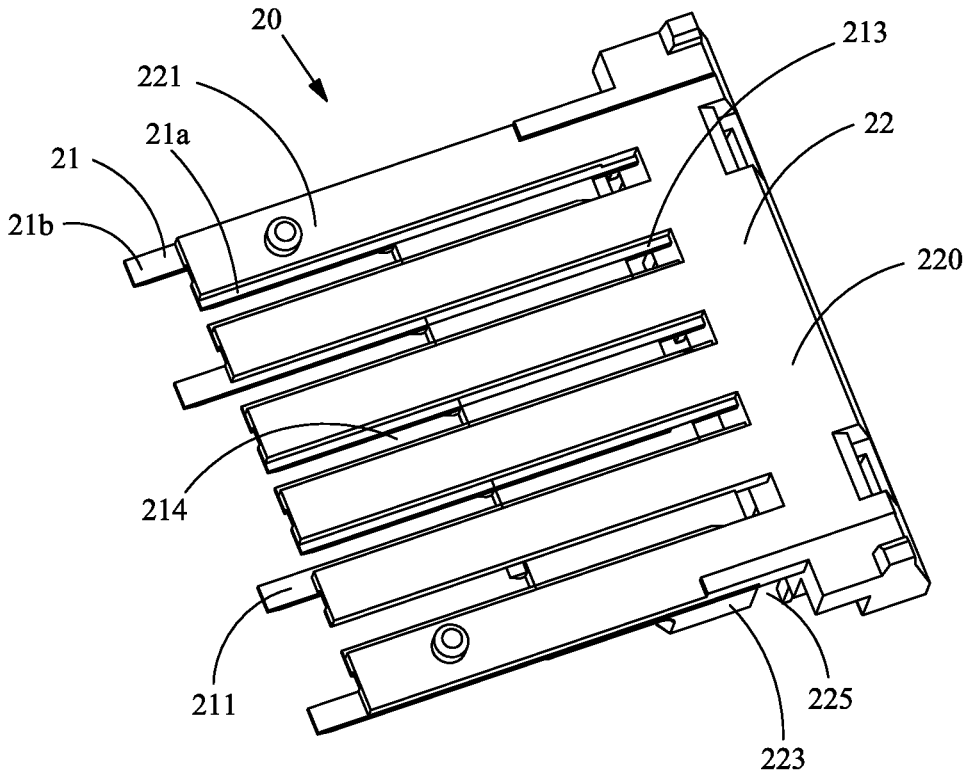


FIG. 5

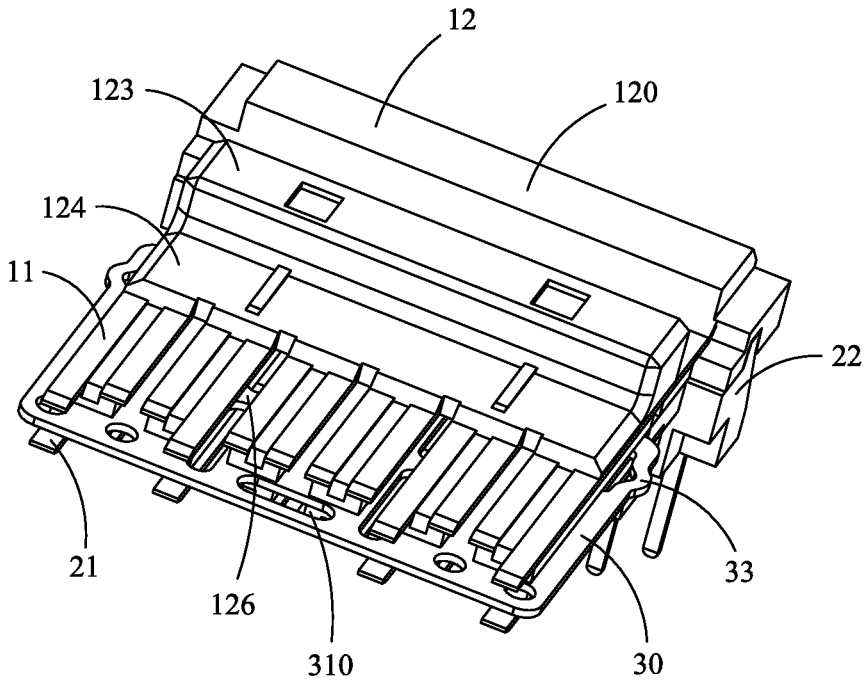


FIG. 6

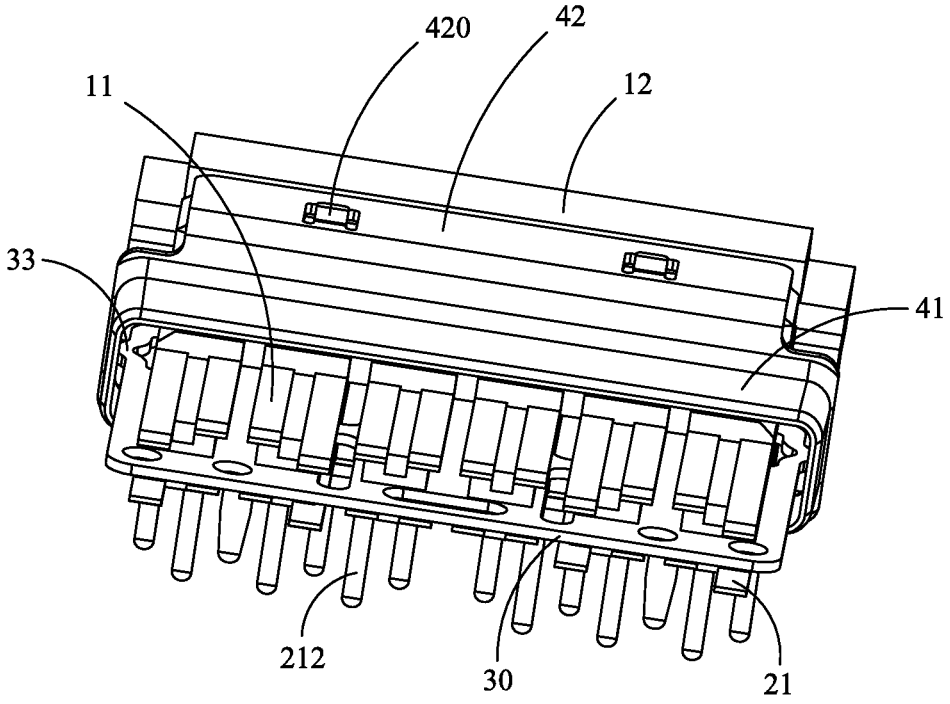


FIG. 7

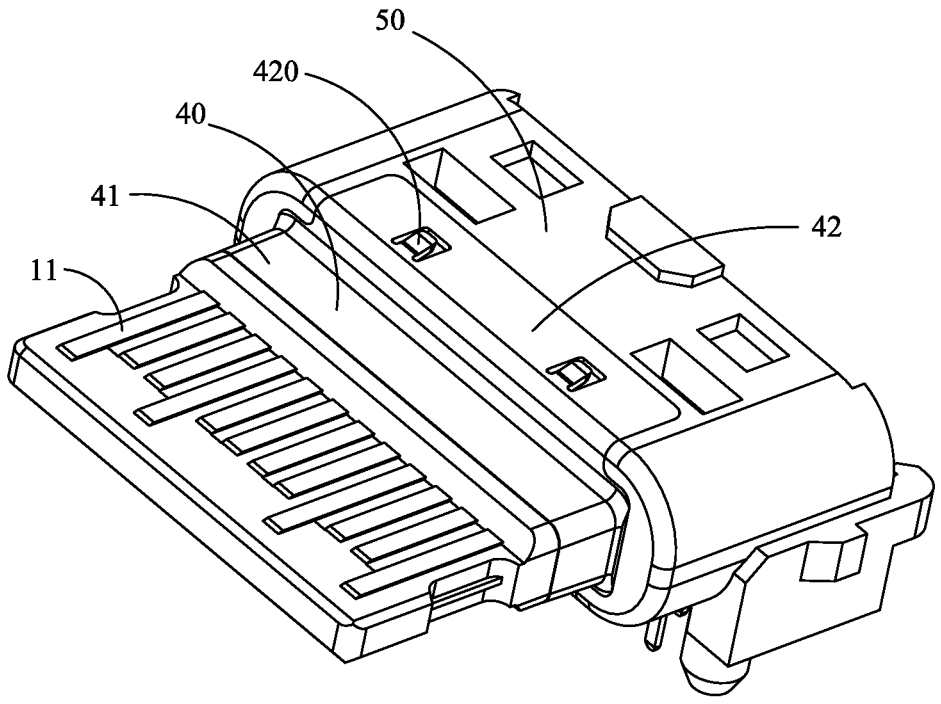


FIG. 8

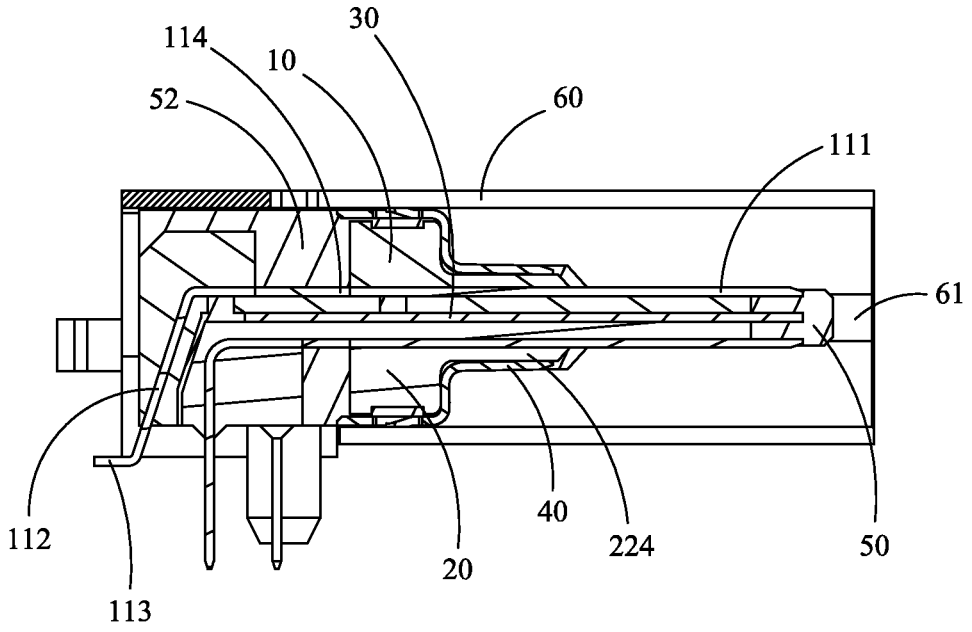


FIG. 9

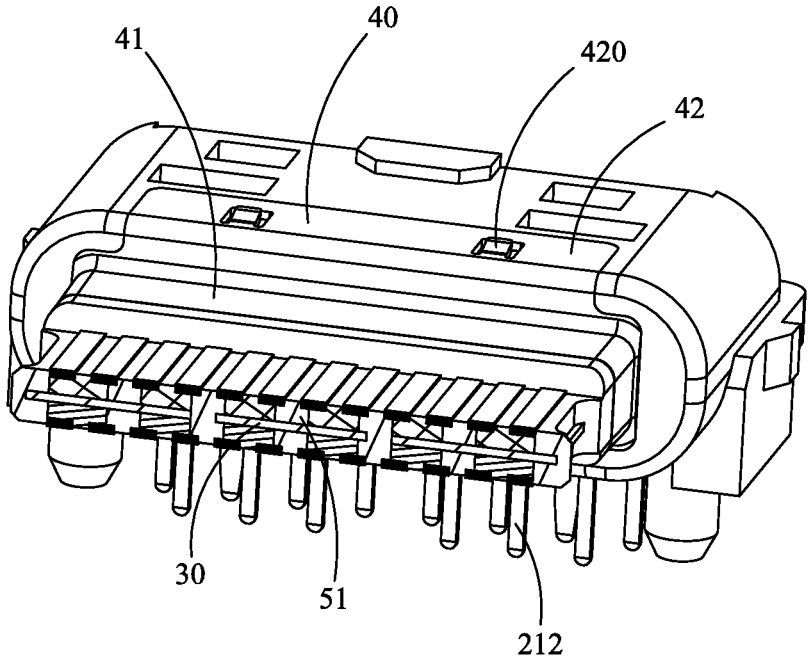


FIG. 10

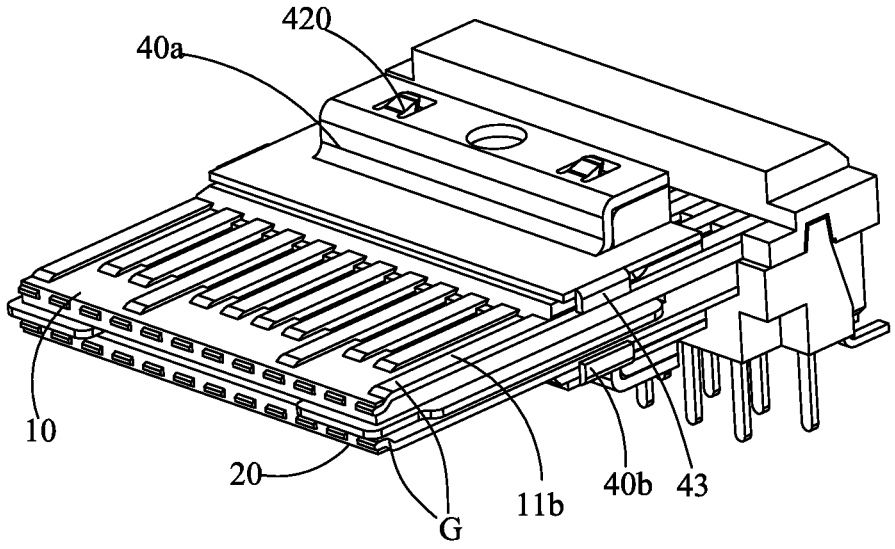


FIG. 11

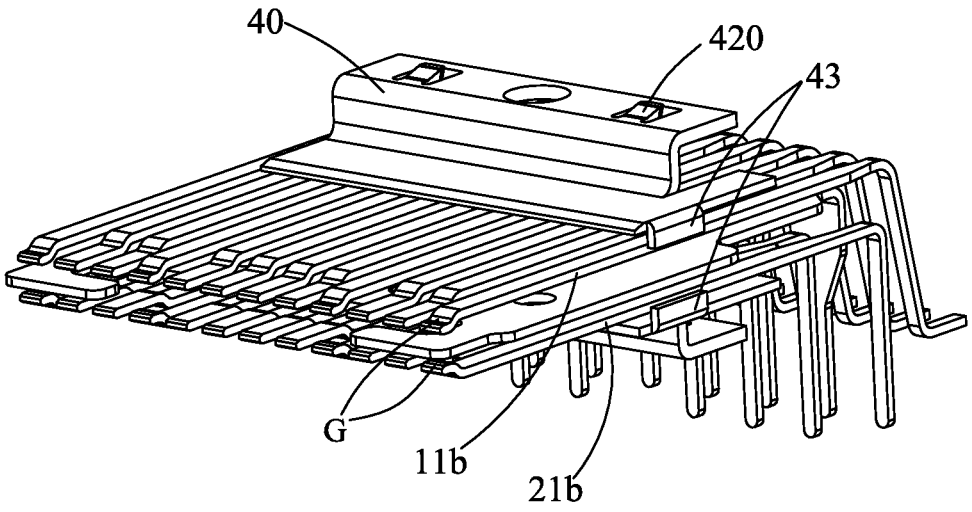


FIG. 12

ELECTRICAL CONNECTOR WITH GROUNDING MECHANISM CONTACTING OUTER SHELL

CROSS REFERENCE TO RELATED APPLICATIONS

The present application claims the priority of Chinese patent application Ser. No. 201410257239.7 filed Jun. 11, 2014 in the SIPO (Sate Intellectual Property Office of the P.R.C.), which is incorporated by reference herein in its entirety.

BACKGROUND

1. Technical Field

The present disclosure relates to an electrical connector, and more particularly to an electrical connector having an improved grounding mechanism for realizing robust grounding effect.

2. Description of Related Art

A conventional I/O connector for being mounted to a circuit board usually includes an insulative housing, a plurality of contacts retained in the insulative housing and an outer shell enclosing the insulative housing. The insulative housing usually includes a base and a tongue portion extending from the base. Since the tongue portion is usually thinner than the base, the strength of the tongue portion maybe not strong enough. The contacts may include a group of first contacts located at a top side of the tongue portion and a group of second contacts located at a bottom side of the tongue portion. Since the first contacts and the second contacts are adjacent with each other, signal interference generated therebetween may render poor signal transmission quality.

Hence, it is desirable to provide an electrical connector with robust grounding effect to improve signal transmission quality.

SUMMARY

The present disclosure provides an electrical connector including an upper contact module, a lower contact module, an outer insulative housing inject-molded with the upper contact module and the lower contact module, a shielding mechanism at least partly fixed in the outer insulative housing and a metallic outer shell enclosing the outer insulative housing. The upper contact module includes a plurality of upper contacts and an upper housing inject-molded with the upper contacts. The lower contact module includes a plurality of lower contacts and a lower housing inject-molded with the lower contacts. The shielding mechanism and the metallic outer shell are in mechanical contact with each other for achieving a relative larger grounding area.

The foregoing has outlined rather broadly the features and technical advantages of the present disclosure in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The components in the drawing are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the described embodiments. In the drawings, reference numerals designate corresponding parts throughout various views, and all the views are schematic.

FIG. **1** is a perspective view of an electrical connector in accordance with a first embodiment of the present disclosure;

FIG. **2** is another perspective view of the electrical connector shown in FIG. **1**;

FIG. **3** is an exploded view of the electrical connector shown in FIG. **1** with an outer shell removed therefrom;

FIG. **4** is a perspective view of an upper contact module;

FIG. **5** is a perspective view of a lower contact module;

FIG. **6** is a perspective view showing that a grounding mechanism positioned between the upper contact module and the lower contact module;

FIG. **7** is a partly assembled view showing an inner shell attached to the upper contact module and the lower contact module;

FIG. **8** is a perspective view showing an outer insulative inject-molded over the upper contact module, the lower contact module and the inner shell;

FIG. **9** is a cross-sectional view taken along line A-A of FIG. **1**;

FIG. **10** is a cross-sectional view taken along line B-B of FIG. **1**;

FIG. **11** is a perspective view of an electrical connector in accordance with a second embodiment of the present disclosure showing the relationships of an inner shell, an upper contact module and a lower contact module; and

FIG. **12** is a perspective view showing a mating status of the inner shell and corresponding grounding contacts.

DETAILED DESCRIPTION OF ILLUSTRATED EMBODIMENTS

Reference will now be made to the drawing figures to describe the embodiments of the present disclosure in detail. In the following description, the same drawing reference numerals are used for the same elements in different drawings.

Referring to FIGS. **1** to **3**, the present disclosure discloses an electrical connector **1** capably of being mounted to a circuit board (not shown) for receiving a plug connector (not shown). The electrical connector **1** includes an upper contact module **10**, a lower contact module **20**, an outer insulative housing **50** inject-molded over the upper and the lower contact modules **10**, **20**, a metallic inner shell **40** and a metallic outer shell **60** fixed in the outer insulative housing **50**, and a grounding mechanism fixed in the outer insulative housing **50**.

Referring to FIGS. **3**, **4** and **6-10**, the upper contact module **10** includes a plurality of upper contacts **11** and an upper housing **12** inject-molded with the upper contacts **11**. According to the illustrated embodiment of the present disclosure, the number of the upper contacts **11** is twelve. Of course, the number can be changed according to different design requirements.

The upper contacts **11** are arranged in a side-by-side manner. Each upper contact **11** includes an upper contacting portion **111** exposed to the air for mating with the plug connector, a slant portion **112** extending slantwise from the upper contacting portion **111**, an upper soldering portion **113** extending horizontally from the slant portion **112**, and an upper connecting portion **114** connected between the upper contacting portion **111** and the slant portion **112**. The upper soldering portions **113** are so-called SMT types and are arranged in a single row for being easily soldered onto a circuit board.

The upper contacts **11** include a plurality of first contacts **11** a for transmitting signal or power (also known as signal contacts or power contacts, respectively), and a plurality of second contacts **11***b* for grounding (also known as ground contacts). In a single row, the first contacts **11***a* are located

between the second contacts **11***b*. Two grounding contacts G of the second contact **11***b* are located at outmost lateral sides. In a single row, according to the illustrated embodiment of the present disclosure, the first contacts **11***a* include three pairs of differential signal contacts and some power contacts.

The upper housing **12** includes an upper base portion **120** and an upper tongue portion **121** extending forwardly from the upper base portion **120**. The thickness of the upper base portion **120** is larger than the upper tongue portion **121**. The upper base portion **120** includes a rear portion **123** and a front portion **124** connected between the upper tongue portion **121** and the rear portion **123**. The front portion **124** is thicker than the upper tongue portion **121**. The upper base portion **120** includes a depression **125**. The upper contact module **10** defines a plurality of upper slots **126** extending therethrough along a vertical direction. The upper slots **126** extend forwardly through the upper housing **12**. Each upper slot **126** is located between a pair of upper contacts **11**. Under this design, for one hand, the upper contacts **11** can be supported by the upper housing **12** when a first injecting mold is completed; for the other hand, a relative large injecting runner can be formed in order to provide a relative large flowing area for better insert molding the outer insulative housing **50** afterwards.

Referring to FIGS. **3**, **5** and **6** to **10**, the lower contact module **20** includes a plurality of lower contacts **21** and a lower housing **22** inject-molded with the lower contacts **21**. According to the illustrated embodiment of the present disclosure, the number of the lower contacts **21** is twelve. Of course, the number can be changed according to different design requirements.

The lower contacts **21** are arranged in a side-by-side manner. Each lower contact **21** includes a lower contacting portion **211** exposed to the air for mating with the plug connector, a lower soldering portion **212** bent downwardly for being mounted to the circuit board, and a lower connecting portion **213** connected between the lower contacting portion **211** and the lower soldering portion **212**. The lower soldering portions **212** are so-called Through Hole types and are arranged in two rows for being soldered through the circuit board. Of course, the arrangement of the upper soldering portions **113** and the lower soldering portions **212** can be designed in other types according to different requirements. For example, the lower soldering portions **212** can also be arranged in a single row and/or the lower soldering portions **212** can also be designed in SMT types.

The lower contacts **21** include a plurality of third contacts **21***a* for transmitting signal or power (also known as signal contacts or power contacts, respectively), and a plurality of fourth contacts **21***b* for grounding (also known as ground contacts). Among the lower contacts **21**, the fourth contacts **21***b* are located at opposite sides thereof for easily getting in contact with the outer shell **60** in order to reduce signal interference. In a single row, the third contacts **21***a* are located between the fourth contacts **21***b*. Two grounding contacts G of the second contact **21***b* are located at outmost lateral sides. In a single row, according to the illustrated embodiment of the present disclosure, the third contacts **21***a* include three pairs of differential signal contacts and some power contacts.

The lower housing **22** includes a lower base portion **220** and a lower tongue portion **221** extending forwardly from the lower base portion **220**. The thickness of the lower base portion **220** is larger than the lower tongue portion **221**. The lower base portion **220** includes a rear portion **223** and a front portion **224** connected between the lower tongue portion **221** and the rear portion **223**. The front portion **224** is thicker than the lower tongue portion **221**. The lower base portion **220** includes a depression **225**. The lower contact module **20** defines a plurality of lower slots **214** extending therethrough along the vertical direction. The lower slots **214** extend forwardly through the lower housing **22**. Each lower slot **214** is located between a pair of lower contacts **21**. Under this design, for one hand, the lower contacts **21** can be supported by the lower housing **22** when a first injecting mold is completed; for the other hand, a relative large injecting runner can be formed in order to provide a relative large flowing area for better insert molding the outer insulative housing **50** afterwards. According to the illustrated embodiment of the present disclosure, the upper contacting portions **111** and the lower contacting portions **211** are of the same type while in a reversed arrangement in order that the plug connector can be inserted into the electrical connector **1** either in a normal insertion or in a reverse insertion.

Referring to FIGS. **2**, **3**, **6**, **7**, **9** and **10**, the grounding mechanism includes a metallic shielding plate **30** stamped from a metal sheet and located between the upper contact module **10** and the lower contact module **20** for reducing signal interference between the upper contacts **11** and the lower contacts **12**. The shielding plate **30** includes a flat body portion **31** and a pair of soldering legs **32** extending downwardly from the body portion **31** for being soldered to the circuit board. The shielding plate **30** can also reinforce the strength of the outer insulative housing **50**. The body portion **31** includes a pair of deformable protrusions **33** on lateral sides thereof.

The width of the body portion **31** is larger than the upper and the lower contact modules **10**, **20**. As a result, the body portion **31** extends sidewardly beyond the upper and the lower contact modules **10**, **20**. The deformable protrusions **33** are capable of contacting either the inner shell **40** or the outer shell **30** for grounding. Besides, the body portion **31** extends forwardly beyond the upper housing **12** and the lower housing **22**.

The body portion **31** includes a plurality of middle slots **310** in alignment with the upper slots **126** and the lower slots **214**. As a result, when inject-molding the outer insulative housing **50**, the flowing plastic can easily flow through the upper slots **126**, the middle slots **310** and the lower slots **214**.

The inner shell **40** is attached to a top side of the upper housing **12** and a bottom side of the lower housing **22**. As shown in FIG. **7**, the deformable protrusions **33** are capable of contacting inner shell **40** for achieving a relative larger grounding area. Besides, the inner shell **40** includes a plurality of elastic tabs **420** for engaging with the outer shell **60**. As a result, the shielding plate **30**, the inner shell **40** and the outer shell **60** are in series connection with each other.

Referring to FIGS. **3** and **7** to **10**, according to the first embodiment of present disclosure, the inner shell **40** is unitary of one piece and includes a first part **41** enclosing the front portions **124**, **224** of the upper base **120** and the lower base **220**, and a second part **42** enclosing the rear portions **123**, **223** of the upper base **120** and the lower base **220**. The elastic tabs **420** are formed on the second part **42**. The front part **41** is of a rectangular frame configuration. The deformable protrusions **33** of the shielding plate **30** abut against inner sides of the front part **41** to establish connection.

The inner shell **40** covers rear ends of the upper and lower tongue portions **121**, **221** so that the roots of the upper and lower tongue portions **121**, **221** do not easily get deformed or cracked. The rear portions **123**, **223** and the front portions **124**, **224** are of a stepped shape for improving the strength of the roots of the upper and lower tongue portions **121**, **221** and

dispersing the stress. The second part **42** is located in front of the depressions **125**, **225** of the upper and the lower bases **120**, **220**.

The outer shell **60** includes a receiving space **61** for receiving the plug connector. The upper tongue portion **121** and the lower tongue portion **221** are received in the receiving space **61**. The upper and the lower tongue portions **121**, **221** are located at a center of the outer shell **60** along the vertical direction in order to realize that the plug connector can be inserted into the electrical connector **1** either in the normal insertion or in the reverse insertion. It is understandable that, in order to realize the plug connector can be inserted into the electrical connector **1** either in the normal insertion or in the reverse insertion, the distance between the upper tongue portion **121** and a top wall of the outer shell **60** is the same as the distance between the lower tongue portion **221** and a bottom wall of the outer shell **60**.

The outer insulative housing **50** is inject-molded over the upper contact module **10**, the lower contact module **20** and the inner shell **40**. The outer insulative housing **50** includes a plurality of stuffing blocks filling in the upper slots **126**, the middle slots **310** and the lower slots **214**, and a plurality of protrusions **52** filling in the depressions **125**, **225**. As a result, a final integral contact module is formed.

FIGS. **11** and **12** discloses another electrical connector **1** which is similar to the first embodiment. The major differences therebetween are the structure of the inner shell **40** and the contacting way between the grounding mechanism and the outer shell **60**.

The inner shell **40** includes a top shell **40***a* covering the upper contact module **10** and a bottom shell **40***b* covering the lower contact module **20**. The top shell **40***a* and the bottom shell **40***b* are separately made and assembled together. According to the illustrated embodiment of the present disclosure, the top shell **40***a* and the bottom shell **40***b* are separately molded for reducing cost and easy manufacture. The grounding mechanism includes the grounding contacts G located at outmost side of the upper contacts **11** and the lower contacts **21**. The top shell **40***a* includes an upper fixing leg **43** extending downwardly to contact the upper grounding contact G/the second contact **11***b*. The bottom shell **40***b* includes a lower fixing leg **43** extending upwardly to contact the lower grounding contact G/the fourth contact **21***b*. As a result, the grounding contacts G are in contact with the inner shell **40**. The inner shell **40** and the outer shell **60** are in contact with each other via the elastic tabs **420**. As a result, the shielding plate **30**, the inner shell **40** and the outer shell **60** are in series connection with each other for achieving a relative larger grounding area.

A method for manufacturing the electrical connector **1** includes the following steps:

- providing the upper contacts **11** and then insert molding the upper housing **12** over the upper contacts **11** so as to form the upper contact module **10**;
- providing the lower contacts **21** and then insert molding the lower housing **22** over the lower contacts **21** so as to form the lower contact module **20**;
- providing the metallic shielding plate **30** sandwiched between the upper contact module **10** and the lower contact module **20**;
- providing the inner shell **40** attached to the outside of the upper contact module **10** and the lower contact module **20**;
- insert molding the outer insulative housing **50** over the inner shell **40** and the upper and the lower contact modules **10**, **20**; and
- provide an outer shell **60** enclosing the outer insulative housing **50**.

Comparing with prior arts, the present discloses are provided with the inner shell **40** and the grounding mechanism which can not only help to improve the strength of the upper and the lower tongue portions **121**, **221**, but also improve shielding effect. As a result, the signal transmission quality can be greatly improved. Besides, the electrical connector **1** has multiple insert molding processes, and the upper slots **126**, the middle slots **310** and the lower slots **214** can help melt plastic flow therethrough.

It is to be understood, however, that even though numerous characteristics and advantages of preferred and exemplary embodiments have been set out in the foregoing description, together with details of the structures and functions of the embodiments, the disclosure is illustrative only; and that changes may be made in detail within the principles of present disclosure to the full extent indicated by the broadest general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. An electrical connector comprising:

an upper contact module comprising a plurality of upper contacts and an upper housing inject-molded with the upper contacts;

a lower contact module comprising a plurality of lower contacts and a lower housing inject-molded with the lower contacts;

an outer insulative housing inject-molded with the upper contact module and the lower contact module;

a shielding mechanism at least partly fixed in the outer insulative housing; and

a metallic outer shell enclosing the outer insulative housing; wherein

the shielding mechanism and the metallic outer shell are in mechanical contact with each other.

2. The electrical connector as claimed in claim **1**, wherein the shielding mechanism comprises a metallic shielding plate sandwiched between the upper contact module and the lower contact module.

3. The electrical connector as claimed in claim **2**, wherein the upper contact module comprises an upper slot extending vertically therethrough, the lower contact module comprises a lower slot vertically extending therethrough, and the metallic shielding plate comprises a middle slot vertically extending therethrough, the upper slot, the middle slot and the lower slot being in alignment with each other along a vertical direction, the outer insulative housing being inject-molded over the upper contact module and the lower contact module, the outer insulative housing comprising a stuffing block filling in the upper slot, the middle slot and the lower slot.

4. The electrical connector as claimed in claim **2**, wherein the metallic shielding plate comprises a flat body portion positioned between the upper contacts and the lower contacts, the flat body portion comprising a deformable protrusion in contact with the metallic outer shell.

5. The electrical connector as claimed in claim **4**, wherein the flat body portion extending sidewardly and frontwardly beyond the upper housing and the lower housing.

6. The electrical connector as claimed in claim **4**, wherein the metallic shielding plate comprises a pair of soldering legs extending downwardly from the flat body portion for being soldered to a circuit board.

7. The electrical connector as claimed in claim **2**, further comprising a metallic inner shell between the outer insulative housing and the metallic outer shell, the metallic inner shell

covering the upper housing and the lower housing, the metallic inner shell comprising an elastic tab engaging with the metallic outer shell.

8. The electrical connector as claimed in claim **7**, wherein the upper housing comprises an upper base and an upper tongue portion extending forwardly from the upper base, the upper tongue portion being thinner than the upper base; the lower housing comprising a lower base and a lower tongue portion extending forwardly from the lower base, the lower tongue portion being thinner than the lower base; each of the upper base and the lower base comprising a rear portion and a front portion thinner than the rear portion, the front portion being thicker than the upper tongue portion and the lower tongue portion; the metallic inner shell being of a unitary one piece, the metallic inner shell comprising a first part covering the front portions of the upper base and the lower base, and a second part covering the rear portions of the upper base and the lower base.

9. The electrical connector as claimed in claim **7**, wherein the metallic inner shell comprises a top shell and a bottom shell, the top shell and the bottom shell being separately made, the top shell being attached to a top side of the upper housing, and the bottom shell being attached to a bottom side of the lower housing.

10. The electrical connector as claimed in claim **7**, wherein the metallic shielding plate comprises a flat body portion positioned between the upper contacts and the lower contacts, the flat body portion comprising a deformable protrusion in contact with the metallic inner shell.

11. An electrical connector comprising:

an upper contact module comprising a plurality of upper contacts and an upper housing inject-molded with the upper contacts, the upper contacts comprising an upper grounding contact;

a lower contact module comprising a plurality of lower contacts and a lower housing inject-molded with the lower contacts, the lower contacts comprising a lower grounding contacts in alignment with the upper grounding contact along a vertical direction;

a metallic shielding plate positioned between the upper contact module and the lower contact module;

a metallic inner shell comprising a top shell attached to the upper housing and a bottom shell attached to the lower housing, the top shell comprising an upper fixing leg extending downwardly to contact the upper grounding contact, and the bottom shell comprising a lower fixing leg extending upwardly to contact the lower grounding contact; and

an outer insulative housing inject-molded with the upper contact module, the lower contact module and the metallic inner shell.

12. The electrical connector as claimed in claim **11**, wherein the top shell and the bottom shell are separately made.

13. The electrical connector as claimed in claim **11**, wherein the metallic shielding plate comprises a flat body portion positioned between the upper contacts and the lower contacts, the flat body portion extending sidewardly and frontwardly beyond the upper housing and the lower housing.

14. The electrical connector as claimed in claim **13**, wherein the metallic shielding plate comprises a pair of soldering legs extending downwardly from the flat body portion for being soldered to a circuit board.

15. The electrical connector as claimed in claim **11**, wherein the upper housing comprises an upper base and an upper tongue portion extending forwardly from the upper base, the upper tongue portion being thinner than the upper base; the lower housing comprising a lower base and a lower tongue portion extending forwardly from the lower base, the lower tongue portion being thinner than the lower base; each of the upper base and the lower base comprising a rear portion and a front portion thinner than the rear portion, the front portion being thicker than the upper tongue portion and the lower tongue portion.

16. The electrical connector as claimed in claim **12**, wherein each of the top shell and the bottom shell comprises a pair of elastic tabs.

17. The electrical connector as claimed in claim **11**, wherein each upper contact comprises a slant portion and an upper soldering portion extending from the slant portion, the upper soldering portions being arranged in a single row and coplanar with each other.

18. The electrical connector as claimed in claim **17**, wherein the lower contacts comprise lower soldering portions extending along the vertical direction, the lower soldering portions being arranged in two rows.

19. The electrical connector as claimed in claim **18**, wherein the upper soldering portions are located at a rear of the lower soldering portions.

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